GNAT1 gene

G protein subunit alpha transducin 1

Normal Function

The *GNAT1* gene provides instructions for making a protein called alpha (α)-transducin. This protein is one part (the alpha subunit) of a protein complex called transducin. There are several versions of transducin made up of different subunits. Each version is found in a particular cell type in the light-sensitive tissue at the back of the eye (the retina), where it plays a role in transmitting visual signals from the eye to the brain.

The transducin complex that contains α-transducin is found only in specialized light receptor cells in the retina called rods. Rods are responsible for vision in low-light conditions. When light enters the eye, a rod cell protein called rhodopsin is turned on (activated), which then activates α-transducin. Once activated, α-transducin breaks away from the transducin complex in order to activate another protein called cGMP-PDE, which triggers a series of chemical reactions that create electrical signals. These signals are transmitted from rod cells to the brain, where they are interpreted as vision.

Health Conditions Related to Genetic Changes

autosomal dominant congenital stationary night blindness

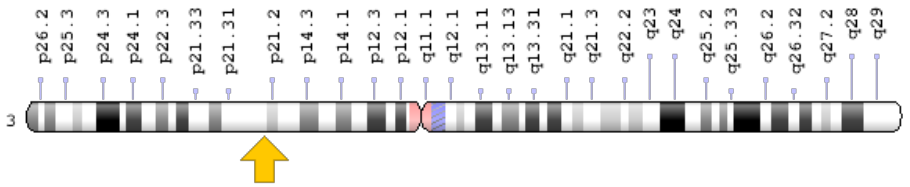
At least two mutations in the *GNAT1* gene have been found to cause autosomal dominant congenital stationary night blindness, which is characterized by the inability to see in low light.

One of these mutations impairs the protein's ability to activate cGMP-PDE; the other mutation results in a protein that is constantly turned on (constitutively activated). Both of these mutations disrupt the pathway that creates visual signals to be sent from rod cells to the brain. A nonfunctional α-transducin protein stops the signaling pathway. When α-transducin is constitutively activated, the signals that the rod cells send to the brain are constantly occurring, even in bright light. Visual information from rod cells is then perceived by the brain as not meaningful, resulting in night blindness.

Chromosomal Location

Cytogenetic Location: 3p21.31, which is the short (p) arm of chromosome 3 at position 21.31

Molecular Location: base pairs 50,191,610 to 50,197,696 on chromosome 3 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- CSNBAD3
- GBT1
- GNAT1_HUMAN
- GNATR
- guanine nucleotide binding protein (G protein), alpha transducing activity polypeptide 1
- guanine nucleotide-binding protein G(t) subunit alpha-1
- guanine nucleotide-binding protein G(T), alpha-1 subunit
- rod-type transducin alpha subunit
- transducin alpha-1 chain
- transducin, rod-specific

Additional Information & Resources

Educational Resources

- Neuroscience (second edition, 2001): Phototransduction https://www.ncbi.nlm.nih.gov/books/NBK10806/
- Webvision: The Organization of the Retina and Visual System: Activation of Rod Phototransduction Cascade (figure) https://www.ncbi.nlm.nih.gov/books/NBK52768/figure/FuPhototran.F6/?report=objectonly

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28GNAT1%5BTIAB%5D%29+OR+%28%28transducin+alpha+subunit%5BTIAB%5D%29+OR+%28transducin+alpha-1%5BTIAB%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+3600+days%22%5Bdp%5D

OMIM

- GUANINE NUCLEOTIDE-BINDING PROTEIN, ALPHA-TRANSDUCING ACTIVITY POLYPEPTIDE 1
  http://omim.org/entry/139330

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
  http://atlasgeneticsoncology.org/Genes/GC_GNAT1.html
- ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=GNAT1%5Bgene%5D
- HGNC Gene Symbol Report
  http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=4393
- NCBI Gene
  https://www.ncbi.nlm.nih.gov/gene/2779
- UniProt
  http://www.uniprot.org/uniprot/P11488

Sources for This Summary

- Dryja TP, Hahn LB, Reboul T, Arnaud B. Missense mutation in the gene encoding the alpha subunit of rod transducin in the Nougaret form of congenital stationary night blindness. Nat Genet. 1996 Jul; 13(3):358-60.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/8673138
- OMIM: GUANINE NUCLEOTIDE-BINDING PROTEIN, ALPHA-TRANSDUCING ACTIVITY POLYPEPTIDE 1
  http://omim.org/entry/139330
- Sandberg MA, Pawlyk BS, Dan J, Arnaud B, Dryja TP, Berson EL. Rod and cone function in the Nougaret form of stationary night blindness. Arch Ophthalmol. 1998 Jul;116(7):867-72.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/9682699
- Szabo V, Kreienkamp HJ, Rosenberg T, Gal A. p.Gln200Glu, a putative constitutively active mutant of rod alpha-transducin (GNAT1) in autosomal dominant congenital stationary night blindness. Hum Mutat. 2007 Jul;28(7):741-2.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/17584859

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